Abstract of: "RISK, AMBIGUITY AND THE SAVAGE AXIOMS"

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Although L. J. Savage's postulates of rational behavior under uncertainty seem valid both normatively and descriptively in many situations, a class of situations is discussed in this paper in which many reasonable people neither wish nor tend to conform to the Savage postulates, even upon reflection. It follows that there is no way to infer (definite) meaningful probabilities for events, even approximately or qualitatively, from their choices in these situations; nor can they be described as acting "as if" they were maximizing the mathematical expectation of utility, in terms of any (definite) probabilities whatever.

For example, imagine an urn known to contain 30 Red balls and 60 Black and Yellow balls, with the proportion of Black to Yellow balls unknown. One ball is to be drawn at random from the urn, and a payoff is specified depending on the color drawn and the action (gamble) chosen from the following two pairs, I and II, III and IV:

	30 Red	60 Black	Yellow
I	$100	$0	$0
II	$0	$100	$0
III	$100	$0	$100
IV	$0	$100	$100

The most common preferences among these actions are: I preferred to II, IV preferred to III. Such persons are violating Savage's Postulate 2, his basic "Sure-thing Principle"; in effect, they are acting "as if" they regarded Red as "more likely than" Black, but at the same time regarded "not-Red" as more

likely than "not-Black", It is impossible to infer even a qualitative probability relationship between Red and Black from their choices.

None of the familiar criteria for predicting or prescribing decision-making under uncertainty (the Savage axioms, minimax, the Hurwicz minimax-maximax criterion, minimax regret) corresponds to this pattern of choices; yet the behavior is deliberate and orderly, and it can be described in terms of a simple, specified decision rule. Such self-consistent behavior violating the Savage axioms seems to occur in situations that can be described as highly "ambiguous": in which available information is in some vital respects scanty or obviously unreliable or conflicting, and expressed "confidence" in estimates of likelihoods is low. In reaching a decision under these circumstances, many people seem to act conservatively; without actually expecting the worst, they choose to act "as if" the worse outcomes were somewhat more likely than their best estimates of likelihood would indicate (the extent of this "bias" depending on their degree of confidence in their estimates). They can be described as choosing an action $\underline{x}$ so as to maximize the index $\rho\, x_{est} + (1 - \rho)\, x_{min}$ (where x_{est} is the expected payoff to action $\underline{x}$ corresponding to the "best guess" probability distribution, x_{min} is the expectation corresponding to the "worst" distribution among the set of "reasonably possible" distributions, and ρ reflects the degree of confidence in the estimated "best guess" distribution).